REMARKS

Applicants thank the Examiner for the thorough examination of the application. No new matter is believed to be added to the application by this amendment.

Status of the Claims

Claims 1-19 are pending in the application. The amendments to the claims improve their language without reducing their scope. Support for claims 17-19 can be found in Table 2 at page 10 of the specification.

Rejection Under 35 USC §103(a) Over Khulbe, Jain and Bearden

Claims 1-16 are rejected under 35 USC §103(a) as being obvious over Khulbe (U.S. Patent 4,299,685) in view of Jain (U.S. Patent 4,999,328) and Bearden. (U.S. Patent 4,134,825). Applicants traverse.

The Present Invention and Its Advantages

The present invention provides a process for hydroconverting a heavy hydrocarbon chargestock which eliminates or dramatically reduces the formation of coke during the operation of a suspension bed hydrogenation reactor. The novel process prolongs the operation lifetime of the hydrogenation reactor unit.

The technology of the invention is typically embodied by claim 1 which sets forth:

> 1. (Currently Amended) A process for hydroconverting a heavy hydrocarbon chargestock, which comprises:
> feeding in an upward way a mixture of a homogeneous catalyst, a heavy hydrocarbon chargestock and hydrogen which is pre-heated to a required temperature into a reactor to carry out a hydrocracking reaction, and
> introducing a solid powder at the position 1/4 to 3/4 of a total length of the reactor from the reactor's bottom so as to adsorb macromolecules of residue formed during the reaction and carry them out of the reactor.

Claim 1, that is, has the following technical features:

1) double catalysts/additives, i.e., a homogeneous catalyst and a solid powder;

2) the homogenous catalyst is first mixed with a heavy hydrocarbon chargestock and hydrogen, and the mixture is preheated before entering into a reactor for the hydrocracking operation;

3) the mixture enters into the reactor in an upward way; and

4) the solid powder is introduced into the reactor at a position 1/4 to 3/4 of the total length of the reactor from its bottom.

The inventive hydroconverting process yields results that are dramatically improved over the conventional hydrocracking processes. These results can be found at Tables 1 and 2 at pages 8-10 of the specification.

Distinctions of the invention over Khulbe, Jain and Bearden.

Khulbe pertains to the hydrocracking of heavy oils/fly ash slurries. In Khulbe, the charge oil in the presence of excess hydrogen is passed through a tubular hydrocracking zone, and the effluent emerging from the top of the zone is separated into a gaseous stream containing a wide boiling range material and a liquid stream containing heavy hydrocarbons. In Khulbe, the chargestock is in the form of a slurry of heavy hydrocarbon oil and finely divided fly ash or high ash coal fines. See Abstract of Khulbe.

Khulbe fails to disclose feeding the chargestock mixture in an upward direction through the hydrocracking reaction zone. Khulbe additionally fails to disclose preheating the mixture to a required temperature before sending it through the hydrocracking reaction zone. Khulbe further fails to disclose the introduction of a solid powder at the position of 1/4 to 3/4 of the total length of the reactor from the bottom so as to absorb the macromolecules of residue formed during the reaction and to carry them out of the reactor. The Examiner admits to these failings (and the failure of Khulbe to disclose many of the process parameters) in detail at pages 3 and 4 of the Office Action.

The Examiner turns to Jain for teachings pertaining to the upward movement of hydrocarbon chargestock through the

hydrocracking zone. See Jain at column 3, lines 35-40. Jain pertains to the hydrocracking of heavy hydrocarbon oils in the presence of iron and petroleum coke additives. See Jain at col. 1, lines 7-10; col. 2, lines 31-35.

The Examiner turns to Bearden for disclosures pertaining to adding a homogenous oil soluble metal catalyst to a hydrocarbon feedstock and the preheating of the hydrocarbon chargestock in hydrogen. See claims 1 and 10 of Bearden. Beardon pertains to a process for the catalytic hydroconversion of heavy petroleum oil (in particular heavy sulfur-containing high-boiling petroleum oil) with a soluble dispersible metal salt. See Beardon at col. 1, lines 7-11; col. 2, lines 18-35. The oil containing the added metal salt is heated in the presence of a hydrogen-containing gas before the hydroconversion reaction. See Beardon at col. 20, lines 42-50.

None of Khulbe, Jain or Bearden discloses or suggests "introducing a solid powder at a position 1/4 to 3/4 of the total length of the reactor from the reactor's bottom so as to absorb macromolecules of residue formed during the reaction and carry them out of the reactor." See independent claim 1.

To establish *prima facie* obviousness of the claimed invention, all the claim limitations must be taught as suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All

words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). See also MPEP 2143.03.

At page 5, line 6-9 of the Office Action, the Examiner asserts "It would have been obvious to one having ordinary skill in the art at the time that the invention was made to utilize a solid powder at the position 1/4 to 3/4 of the total length of the reactor from the bottom so as to absorb the macromolecules of residue formed doing the reaction to carry them out of the reactor." However, the Examiner fails to point out where in Khulbe, Jain or Bearden this limitation is disclosed or suggested.

Khulbe, that is, introduces solid powder (fly ash or high ash coal fines) into a reactor together with a heavy hydrocarbon oil, after mixing with each other, at a position at the bottom of the reactor. This results in the shortcoming that the homogeneous catalyst will be adsorbed by the solid powder and deposits thereon, and the hydrocarbon activity of the homogeneous catalyst would be greatly lowered to thus form coke during the reaction.

Comparative Examples 4 and 5 of the specification demonstrate this shortcoming, where the solid powder and the homogeneous catalyst are simultaneously introduced into a reactor from the inlet. As a result, the comparative product oils contain much more coke than the product oils of the present invention. See Table 2,

page 13 of the specification. In the present invention, the solid powder is not introduced from the inlet of the reactor after being mixed with the chargestock. Instead, the solid powder is introduced at a position of 1/4 to 3/4 of the total length of the reactor measured from the bottom. In this way, coke formation is effectively inhibited.

Therefore, the applied art of Khulbe, Jain and Beardon disclose different inventions having different technical effects, and none of these references disclose or suggest introducing the solid powder at a position 1/4 to 3/4 of the total length of the reactor measured from the bottom. A person having ordinary skill would therefore not be motivated by Khulbe, Jain and Beardon to produce an embodiment of the invention "introducing a solid powder at a position 1/4 to 3/4 of the total length of the reactor from the reactor's bottom so as to absorb macromolecules of residue formed during the reaction and carry them out of the reactor." See independent claim 1.

As a result, the Examiner has failed to establish *prima facie* obviousness of claim 1 over Khulbe, Jain and Bearden. Claims dependent upon claim 1 are patentable for at least the above reasons.

Further, even if it is assumed *arguendo* that Khulbe, Jain and Bearden are sufficient to allege *prima facie* obviousness over the

invention, unexpected results rebut any obviousness that can be alleged.

The unexpected results of the invention can be found in Table 2 at pages 8-10 of the specification. Comparative examples 1-5 correspond to the conventional art suspension bed hydrogenation processes that do not inject powder at the 1/4 to 3/4 inlet positions. This is especially applicable to the Khulbe and Jain patents which are discussed in the paragraph bridging pages 1 and 2 of the specification.

As can be seen from Table 2, the process performed according to the present invention is dramatically less coke formation. Examples 1-4 of the invention yield 0.02-0.07 wt% of coke formed. In comparison, Comparative Examples 1-5 yield undesired coke at a level an order of magnitude higher in a range of 0.25-0.43%. Thus, the advantages of the invention are clear.

As has been shown, the applied art of Khulbe, Jain and Bearden are insufficient to allege *prima facie* obviousness over the invention. Even if *prima facie* could be alleged, unexpected results offer full rebuttal. Accordingly, this rejection is overcome and withdrawal thereof is respectfully requested.

Prior Art Made of Record

The prior art made of record and not relied upon by the Examiner illustrates the status of the conventional art that the invention supersedes. Accordingly, no additional remarks are necessary.

Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert E. Goozner, Ph.D. (Reg. No. 42,593) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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